VERIFICATION

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the undersigned, hereby declare that I am familiar with both the German and English languages and that the attached English text is an accurate translation of **DE 102 42 329.6.**

Signed this: 7th day of May 2009

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Intervertebral disc prosthesis

The invention relates to an intervertebral disc prosthesis according to the preamble of patent claim 1 or according to the preamble of patent claim 5.

An intervertebral disc prosthesis of this kind is known from DE 42 08 116 C. Further known from EP 0 471 821 B is an intervertebral disc prosthesis which has a core constructed as spherical on one side.

The object of the invention is to create an intervertebral disc prosthesis of the initially described kind which is improved with respect to the prior art.

This object is achieved by an intervertebral disc prosthesis according to patent claim 1 or according to patent claim 5.

In the intervertebral disc prosthesis according to patent claim 1 damping is therein in particular provided in the end region of the tilting movement. In the intervertebral disc prosthesis according to patent claim 5 vertical damping is in particular improved and axial rotation limited.

Further developments of the invention are characterised in the subordinate claims.

Further features and advantages of the invention emerge from the description of embodiment examples using the figures.

Fig. 1 shows a perspective side view of a first embodiment.

Fig. 2 shows a section through the embodiment shown in Fig. 1.

Fig. 3 shows a perspective side view of a second embodiment.

Fig. 4 shows a section through the embodiment shown in Fig. 3.

Fig. 5 shows a section through a third embodiment.

Fig. 6 shows a section through a fourth embodiment.

Fig. 7 shows a perspective view of the embodiment shown in Fig. 6.

Figs. 8 to 10 show horizontal plan views of a detail.

As can be seen from the figures, each embodiment of the intervertebral disc prosthesis has a base plate 1, a top plate 2 opposite this and an intervening core 3.

In the first embodiment example shown in Figs. 1 and 2 the base plate 1 has a flat outer face 4 on the outer side facing away from the core. On its outer edge the base plate has teeth 5 extending vertically outwards towards the outer face, which serve to engage in an adjacent wall of a vertebral body. On the inner side opposite the outer face 4 the base plate has a concave recess 6, preferably constructed as a spherical segment. Adjoining the concave recess and encircling it there extends an edge zone 7 parallel to the outer face 4.

As can be seen from Fig. 2, the top plate 2 is constructed identically to the base plate 1 and arranged only as mirror-

symmetrical, so the concave recess 6′ of the top plate 2 of the concave recess 6 is facing the base plate 1.

Between base plate 1 and top plate 2 is the core 3. This has a central part 9 arranged symmetrical to the symmetrical axis 8 and having the form of a biconvex lens and the convex outer faces of which in each case have the same curve, and in particular spherical curve, as the concave recesses 6 or 6′ of the base plate and top plate cooperating therewith.

As can further be seen from Fig. 2, the core 3 also has an edge zone 10, the outer diameter of which is identical to the diameter of the base and top plates. The edge zone is preferably constructed in such a way that the two faces facing the base plate and the top plate are constructed as parallel to one another and to the symmetrical plane of the core.

As can further be seen from Fig. 2, the edge zone 10 has an annular recess 11 on the underside facing the base plate 1 adjacent to the central part 9. In the embodiment example shown this has a cross-section shaped like a segment of a circle. The face opposite this of the edge zone 7 of the base plate has an annular recess 12 having the same diameter and likewise having a cross-section shaped like a segment of a circle.

As can be seen from Fig. 2, the surface of the edge zone 10 facing the top plate 2 is constructed as symmetrical to the side facing the base plate and has a corresponding annular recess 11′. The side of the top plate 2 facing the core, like the base plate 1, likewise has an annular recess 12′ opposite

annular recess 11', which corresponds in dimensions to annular recess 11'.

As can further be seen from Fig. 2, rings 13 or 13' are arranged in the respective pairs 11, 12 or 11', 12' of the annular recesses.

The base plate 1 and the top plate 2 are made of a biocompatible material, in particular steel or titanium. According to a first embodiment the core 3 is formed from a body-compatible high-molecular polyethylene synthetic material. The two rings are formed from a body-compatible elastic synthetic material, for example medical grade silicone rubber.

In use, after removal of the damaged intervertebral disc, the thus constructed intervertebral disc prosthesis is inserted between two vertebral bodies and engages with the teeth 5, 5' in the adjacent vertebral body walls, so the plates themselves are held as fixed against rotation. The rings 13, 13' effect cushioning of the intervertebral disc prosthesis against over-severe tilting and simultaneously curb over-severe twisting about the central axis 8.

The outer diameter of base and top plates is chosen in such a way that it is slightly smaller than the smallest diameter of the adjacent vertebral body end plate face.

The embodiment examples shown in Figs. 3, 4 and 5 are also in each case constructed as mirror-symmetrical about the central plane extending perpendicular to the symmetrical axis 8.

The second embodiment shown in Figs. 3 and 4 again has a base plate 21, a top plate 22 and a core 23 in between.

The base plate 21 again has teeth 25 projecting outwards. The outer face 24, as can best be seen from Fig. 4, is constructed as a convex surface shaped like a segment of a sphere, wherein the curve of the surface is chosen in such a way that it substantially corresponds to a typical concave curve of a vertebral body end plate face to be brought into contact therewith. Symmetrical to the symmetrical axis 8 the surface facing the core has a concave recess 26 corresponding to concave recess 6. A first edge zone 27 is provided, which, by contrast with the first embodiment example, is not constructed as flat but tapering off in the shape of a truncated cone towards the outer side of the base plate.

As can be seen from Fig. 4, the top plate 22 is constructed identically to the base plate and arranged as mirror-symmetrical to a central plane extending perpendicular to the symmetrical axis 8.

The core 23 is constructed in three parts and consists of two plan-convex lenticular bodies 28, facing one another with their plan faces and between which a plan-parallel plate 29 is arranged. The lenticular bodies 28, 28′ and the plate 29 have substantially the same diameter. The curve of the convex faces of the lenticular bodies corresponds to the curve of the concave recesses 26, 26′ cooperating therewith.

As can best be seen from Fig. 4, the core 23 has a bore 30 extending perpendicular to its symmetrical plane and going through its central point. At the corresponding points the

base plate and the top plate have continuous recesses 31, 31′ extending along their symmetrical axes. On the respective sides facing the outer faces 24, 24′ they are extended in diameter by countersunk bores 32, 32′. In the bore 30 a connecting sleeve 33, preferably made of a body-compatible synthetic material or of metal, is provided, the diameter of which is smaller than the diameter of the bore 30 and its length greater than the length of the bore 30, so the connecting sleeve engages with the respective open end in the recess of the adjacent plate. As can be seen from Fig. 4, the sleeve is constructed as tapered in each case towards its ends. A screw 34, 34′ is screwed into the connecting sleeve 33 from both sides, guided in each case through the recesses 31, wherein the head of the screw always rests in the countersunk bore. The countersunk bore is slightly larger than the respective head. The screws are tightened to such an extent that base plate, top plate and core are connected to one another in such a way that the adjacent faces are held without play but movable in respect of one another.

As can be seen from Fig. 4, the depth of the countersunk bores 32, 32′ is slightly larger than the thickness of the heads of the screws 34, 34′. The countersunk bores are covered towards the outside at their outer end in each case by cover plates 35. The difference between the depth of the countersunk bores 32, 32′ and the thickness of the heads of the screws 34, 34′ is chosen in such a way that the heads do not quite come up against the cover plates 35 when the intervertebral disc prosthesis is pressed together by elasticity.

The base and top plates are preferably constructed of the same material as in the first embodiment. The lenticular bodies 28,

28′ preferably have the same material construction as the base and top plates. Plate 29 is formed from a body-compatible elastic synthetic material, preferably a medical grade silicon rubber. In this way the lenticular bodies together with the base and top plates take on the tilting movement, while plate 29 takes care of the elasticity and therefore the cushioning.

The embodiment shown in Fig. 5 differs from the embodiment shown in Figs. 3 and 4 only in the construction of the core. All other parts coincide with the previously described embodiment.

The core 43 again has two outer plan-convex lenticular bodies 48, 48′, which cooperate with the base and top plates with their convex faces in the same way as previously described. The central bore and the fastening by means of the connecting sleeve and the screws also coincides identically. Differently from in the previous embodiment example, instead of the plan-parallel plate 29, an elastic ring 49 is provided. For accommodating and guiding the ring 49 the plan faces of the lenticular bodies 48, 48′ facing one another have annular recesses 50, 50′, shaped in cross-section as segments of a circle, in which the ring 49 is held.

The materials and the mode of operating and fitting correspond to the previously described embodiment example. The ring takes on the function of the plate.

In the further embodiment shown in Fig. 6 the top plate coincides with the top plate described in Fig. 4. In Fig. 6 the outer face 54 is illustrated as flat, but it can also be

constructed, as in the embodiment shown in Fig. 4, as convex corresponding to face 24′.

The base plate 51 is differently constructed, however. It is constructed as a cylindrical element which has on its side facing the top plate a flat face 57 with a diameter which is identical to the diameter of the top plate. On its side facing away from the top plate a cylindrical section 58 adjoins, the diameter of which is slightly smaller, so the section with larger diameter located above forms a stop. Section 58 serves to accommodate a cylindrical casing 59, which can best be seen in the perspective illustration in Fig. 7. The cylindrical casing is placed on to section 58 in snug fit and has on its open end teeth 55 which can be brought into engagement with the adjacent vertebral body. The cylindrical casing further has recesses 60 which substantially improve the ability to grow in.

The core 53 has on its side facing the top plate 52 a plan-convex lenticular body 61, corresponding to the lenticular body 28′ in form and material. On the side facing away from this lenticular body a plan-parallel plate 62 is provided between its plan surface and the flat surface 57 of the base plate 51. The connection shown only schematically in Fig. 6 between base plate 51 and top plate 52 with the core 53 in between is constructed in the same way as in the two previously described embodiments. In this embodiment the movement takes place via the sliding pair of lenticular body 61 and top plate 52. Damping is taken on by plate 62.

In Fig. 8 a horizontal plan view on to a top plate of the embodiments described in Figs. 3 to 7 is shown, the cover plate 35′ and the head of the screw 34′ having been omitted.

From Fig. 8 can be seen that the respective sleeve 33 is constructed on its ends, chamfered in each case in tapered manner, as hexagonal, the faces between the six corners being constructed in each case as channel-like. The respective recess 31′ accommodating this hexagonal section is likewise constructed as hexagonal, the respective diameter through two opposite corners being slightly larger by a predetermined measurement in each case than the corresponding diameter of the connecting sleeve at this point. The faces between two corners in each case are constructed as bulging towards the centre of the recess, the radius of the bulging curve being in each case slightly larger by a predetermined measurement than the radius of the channels.

As shown in Fig. 9 and Fig. 10, a rotation by a measurement predetermined by the differences in size between sleeve and top plate or sleeve and base plate can thus take place. In this way limitation of the rotation to a predetermined angle is achieved.

In all the embodiments shown the outer faces of base and top faces can be constructed as rough, in order to achieve improvement of growing in.

In all the above-described embodiments the adjacent faces carrying out a relative movement in respect of one another can be coated with appropriate material as sliding pairing.

Ceramic layers or else polyethylene coatings or else appropriate metal alloys are particularly suitable for this.

In the above-described embodiments concave and convex spherical faces adjacent to one another and cooperating in each case are described. In each case the core therein has the convex faces and the top plate and the base plate have associated concave spherical faces. According to a modified embodiment the face shapes can be reversed in each case. In other words, the core can be constructed as a biconcave lenticular body or as a plan-concave lenticular body and the associated contact face of base plate and top plate is then constructed as spherically convex corresponding to the concave spherical face.

Patent claims

1. Intervertebral disc prosthesis with a baseplate (1, 21, 51) and a top plate (2, 22, 52) opposite this and an intervening core (3, 23, 53), wherein at least one of the plates has on the side facing the core a first concave contact face (6, 26) and the core has at least one adjacent first convex contact face, characterised in that encircling one of the contact faces a groove (11, 11', 12, 12', 50, 50') is provided in which an elastic first ring (13, 13', 49) in contact with the opposite contact face is embedded.

2. Intervertebral disc prosthesis according to claim 1, characterised in that, also encircling the opposite contact face, a groove is provided in which the first ring engages.

3. Intervertebral disc prosthesis according to claim 1 or 2, characterised in that, also encircling one of the second contact faces, a groove is provided in which an elastic second ring in contact with the opposite contact face is embedded.

4. Intervertebral disc prosthesis according to claim 3, characterised in that, also encircling the opposite contact face in contact with the second ring, a corresponding groove is provided.

5. Intervertebral disc prosthesis with a base plate (1, 21, 51), a core in contact therewith, which has a convex surface on its side facing away from the base plate, and an adjoining top plate, which has on the side facing the core a section constructed as concave, characterised in that the core (23,

53) comprises an elastic layer (29, 49, 62) facing the base plate (21, 51) and a sliding face comprising the convex part.

6. Intervertebral disc prosthesis according to claim 5, characterised in that the base plate also has a concave section and the core adjacent to the elastic layer comprises a convex sliding layer in engagement with the concave section.

7. Intervertebral disc prosthesis according to claim 6, characterised in that the core is constructed as biconvex and has in its centre an elastic intermediate layer.

8. Intervertebral disc prosthesis according to one of claims 5 to 7, characterised in that along a central axis extending from the base plate to the top plate a mandrel is provided to limit the relative movement between base and top plate about the central axis.

9. Space keeper according to one of claims 1 to 8, characterised in that in each case the contact faces of the base or top plate are constructed as convex and the contact faces of the core as concave.

Abstract

An intervertebral disc prosthesis is created which in a known way has a base plate (1) and a top plate (2) opposite this and an intervening core (3). At least one of the plates has on the side facing the core a first concave contact face (6). At least one adjacent first convex contact face is provided on the core. To improve guidance and elasticity, encircling one of the contact faces, a groove (11) is provided in which an elastic ring (13) in contact with the opposite contact face is embedded.

(Fig. 2)

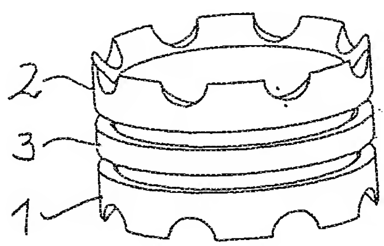

Fig. 1

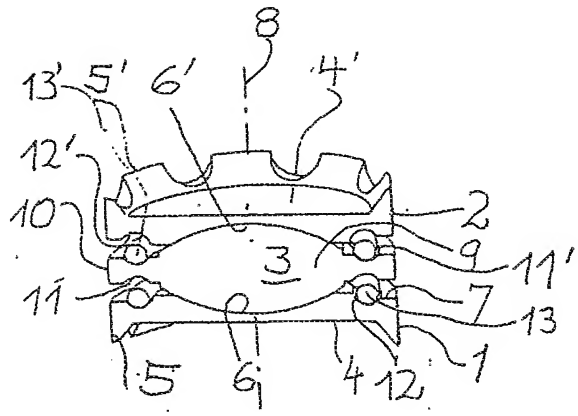

Fig. 2

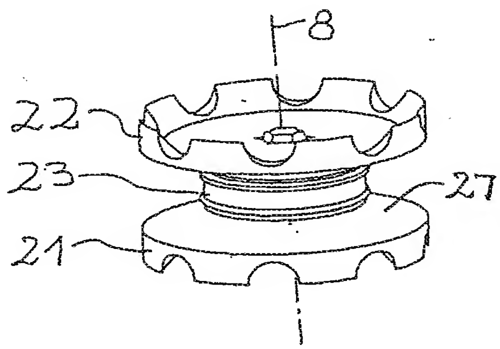

Fig. 3

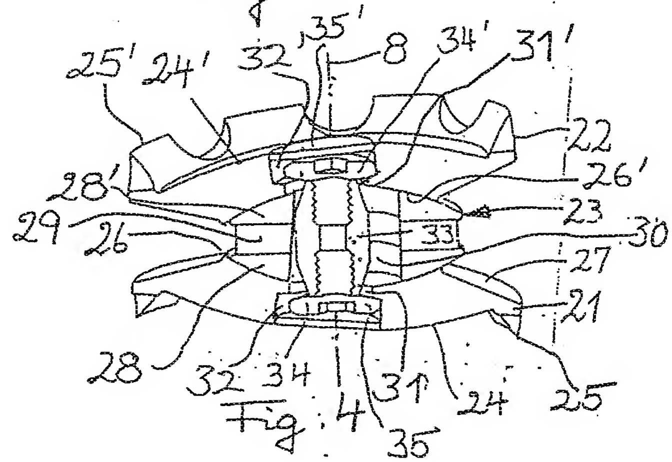

Fig. 4

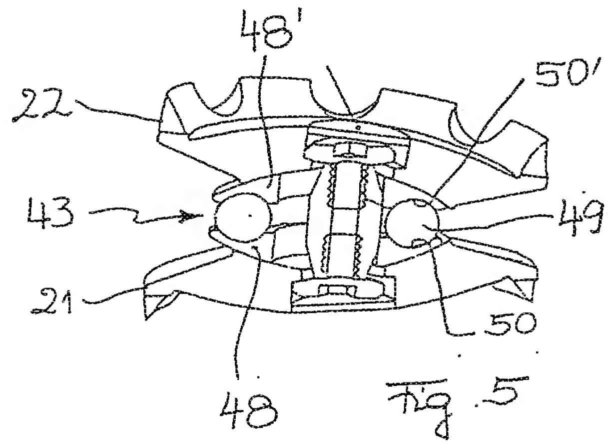

Fig. 5

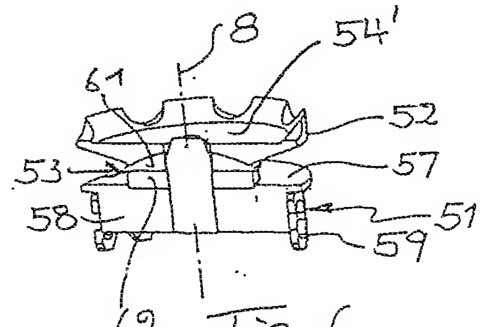

Fig. 6

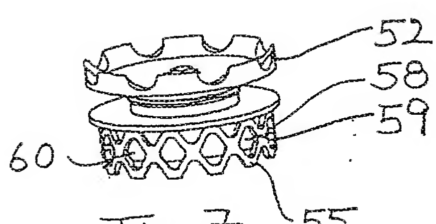

Fig. 7

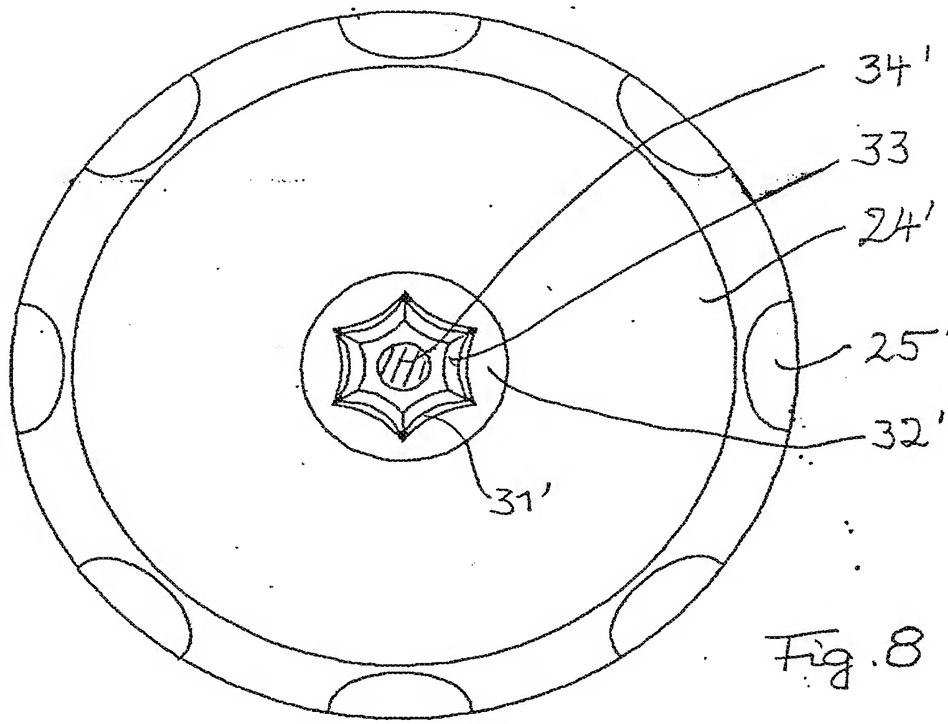

Fig. 8

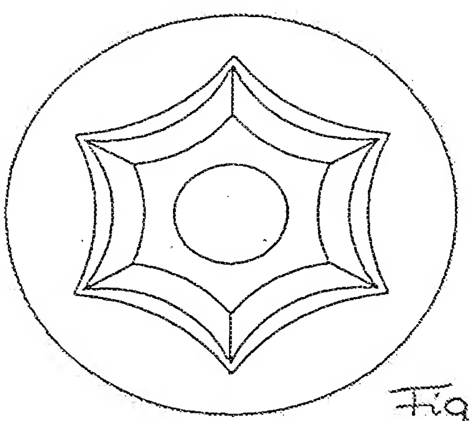

Fig. 9

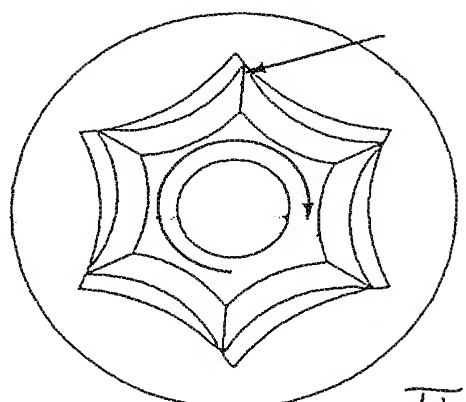

Fig. 10